

# **Basewide Energy Systems Plan**

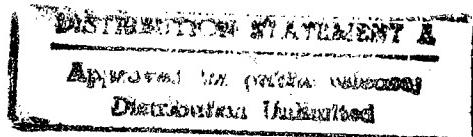
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**Executive Summary  
Final Report**

**Fort Jackson, South Carolina**

**January 1983**

Prepared For  
MOBILE DISTRICT CORPS OF ENGINEERS  
MOBILE, ALABAMA  
CONTRACT DACA01-77-C-0094



Prepared By  
BLACK & VEATCH  
CONSULTING ENGINEERS  
KANSAS CITY, MISSOURI

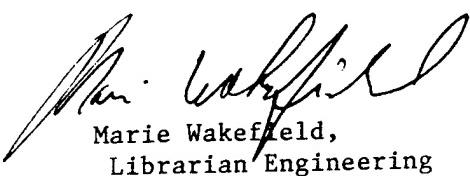


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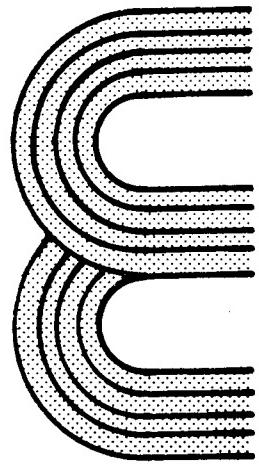
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A handwritten signature in black ink, appearing to read "Marie Wakefield".

Marie Wakefield,  
Librarian Engineering



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## EXECUTIVE SUMMARY - INCREMENTS A, B, C, D and E

This is a summary of the results for Increments A, B, C, D and E of the Basewide Energy Systems Plan for Fort Jackson, South Carolina (the results for Increments F and G are summarized on pages 5 and 6). This plan includes analyses and recommendations of energy conservation projects for reduction of the installation's present energy consumption. The installation should be aware that savings figures presented in this summary can only be realized after all projects have been implemented. Black & Veatch has developed projects that would meet the funding requirements for the energy conservation program. Furthermore, the recommended projects provide partial compliance with the energy conservation requirement for the installation as outlined in the Army Facilities Energy Plan. This summary presents data on the following:

- Existing energy consumption
- Source energy reductions due to energy conservation techniques for buildings and their systems
- Application of solar energy to reduce fossil fuel consumption
- Savings utilizing central energy monitoring and control systems (EMCS)
- Use of solid waste as an alternate energy source
- Analysis of Total Energy/Selective Energy (TE/SE) systems

Tables 1 and 2 present information pertaining to the physical descriptions and energy consumption of 49 typical buildings used to verify historical energy consumption in the development of the basewide

energy use model. This model was then utilized as the foundation for energy conservation project analyses and recommendations. Table 3 summarizes the daily personnel occupancy for each typical building. Tables 1, 2 and 3 also provide information which may be used to estimate source energy consumption for similar buildings within the designated groupings (See Appendix A for all tables referenced in this report). The estimated annual source energy consumption for all building types contributing to the basewide annual total of 2,610,664 mega-Btu, consumed during base year 1975, is shown on Figure 1.

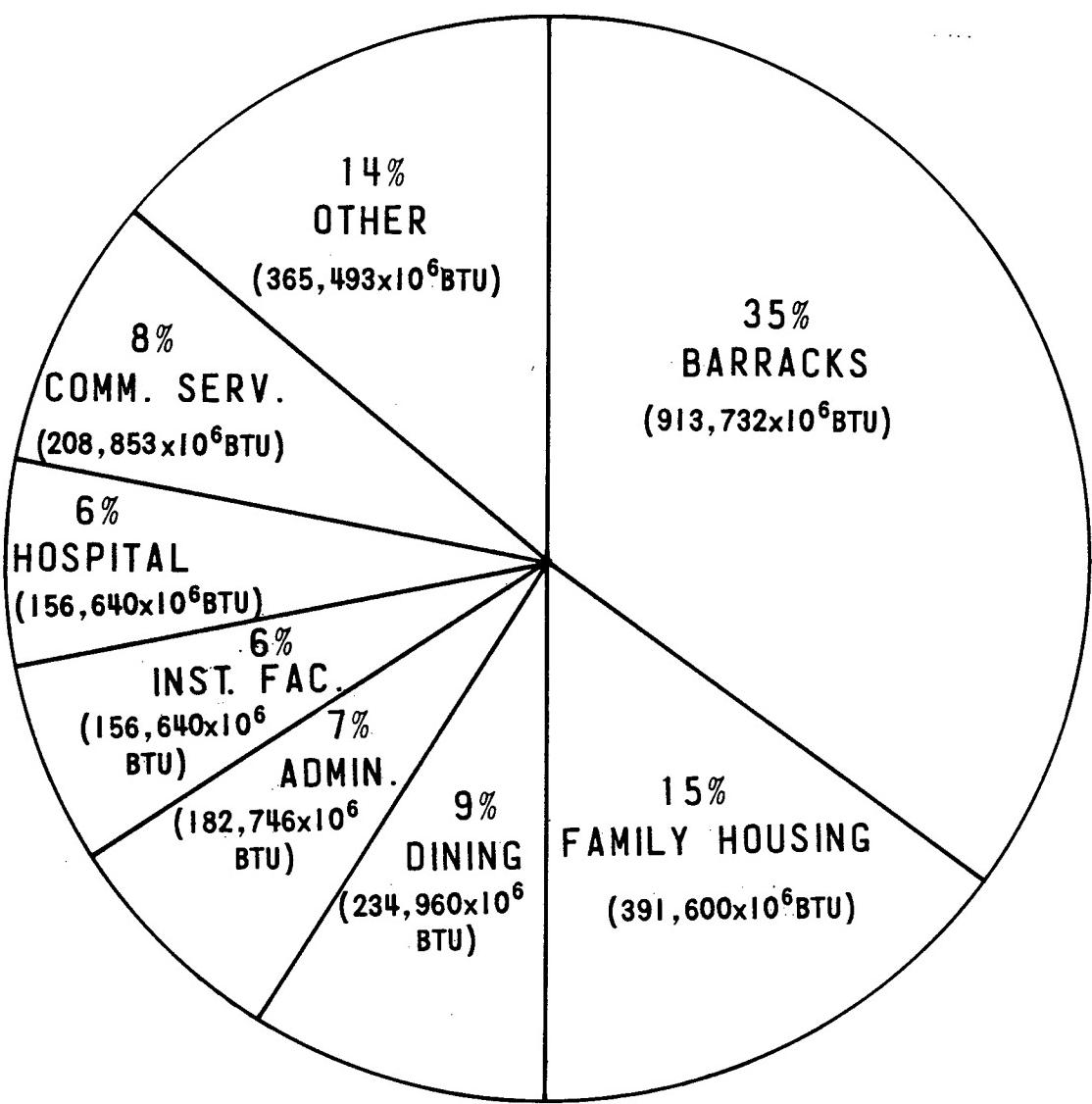
Table 4 indicates the annual source energy consumed by each of the significant building groups used in our basewide energy model. The model was within 10 percent of the historical source energy consumption for FY 1978 shown below.

Yearly Source Energy<sup>6</sup>  
Consumption in Btu x 10<sup>6</sup>

1978

Electricity	1,093,555
Natural Gas	1,087,538
Propane Gas	7,135
Fuel Oil No. 1 & 2	201,868
Fuel Oil No. 5 & 6	<u>327,925</u>
TOTAL	2,718,021

The total estimated source energy savings due to implementation of all feasible energy conservation projects developed within the scope of this study is 596,984 mega-Btu/year. These projects consisted of various architectural improvements, and mechanical and electrical system modifications.

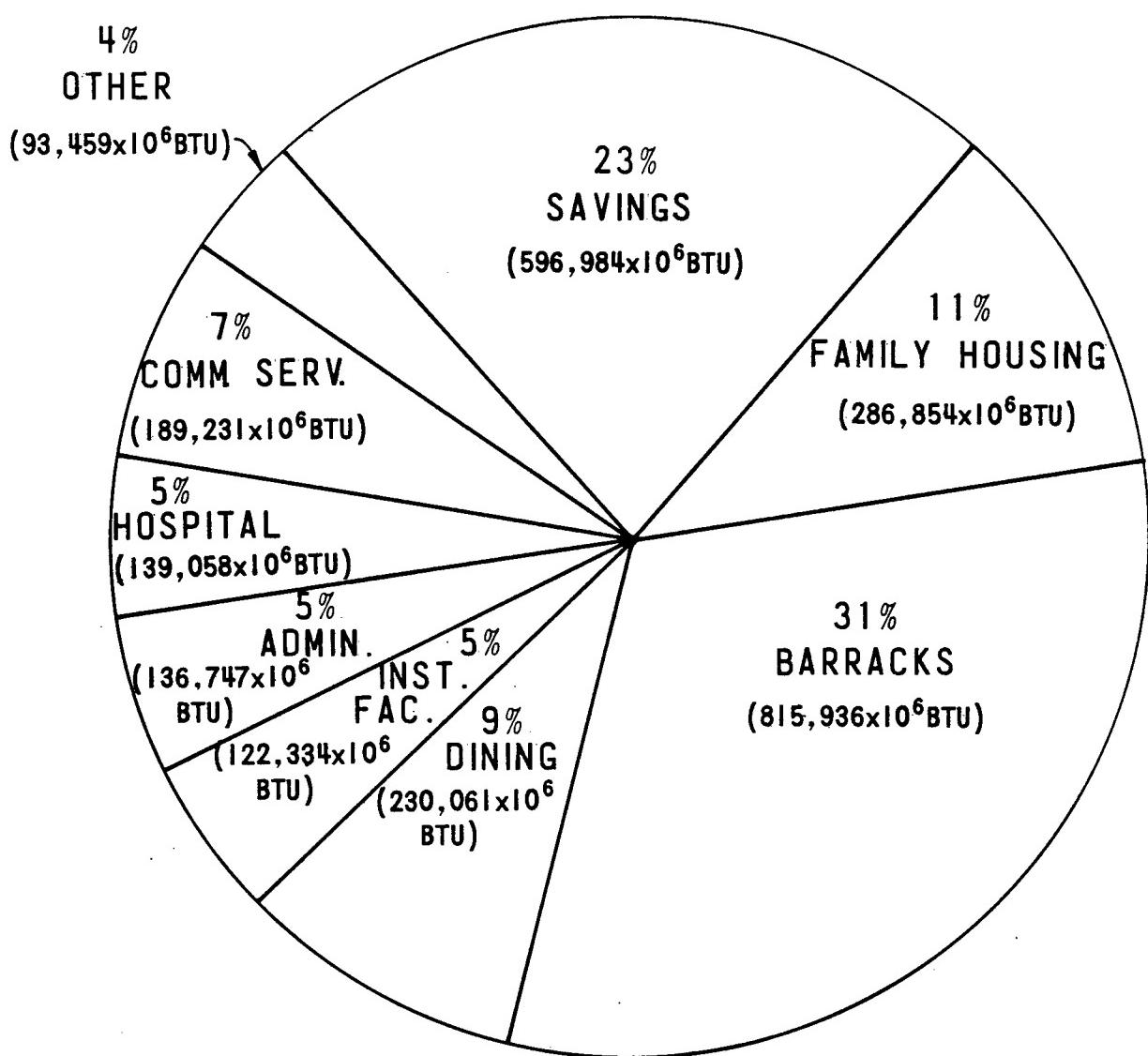


BASEWIDE CONSUMPTION FY '75  
(2,610,664x10<sup>6</sup>BTU)

FIGURE 1

Table 5 lists the project number, percent of basewide reduction, and the source energy savings for the indicated building types. Figure 2 illustrates the combined effect of the recommended energy saving improvements, as compared to the FY 1975 source energy expenditure. Our estimates indicate a savings of approximately 23 percent over the base year (1975). Figure 3 illustrates the relative percent reduction for significant bulding groups comprising the 596,984 mega-Btu/year.

A detailed analysis of the projects listed in Table 5 is included in the following reports. Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis can be found in the Energy Use Survey. Utilizing solar energy, a renewable energy source, to reduce Fort Jackson's dependence on nonrenewable energy sources revealed that the projects investigated would be economically impracticable. Eight concepts were evaluated, and are presented in the Solar Energy Applications and Evaluation. The Energy Monitoring and Control Systems (EMCS) study includes recommendations for additional energy saving programs supplementing the EMCS system under design and the utilization of an FM control system. The additions to the EMCS system under design would result in a savings of 101,568 mega-Btu/year, while the FM control system would save 44,592 mega-Btu/year. The investigation of solid waste for reducing source energy consumption at Fort Jackson resulted in the development of Project No. T-529, which recommends the installation of a solid waste-buring incinerator facility to provide steam to the existing steam distribution system. The proposed plant,



BASEWIDE CONSUMPTION AFTER ENERGY  
CONSERVATION PROJECTS  
 $(2,013,680 \times 10^6 \text{ BTU})$

FIGURE 2

ALLOCATION OF ENERGY CONSERVATION  
PROJECTS SAVINGS

FOR SIGNIFICANT BUILDING GROUPS

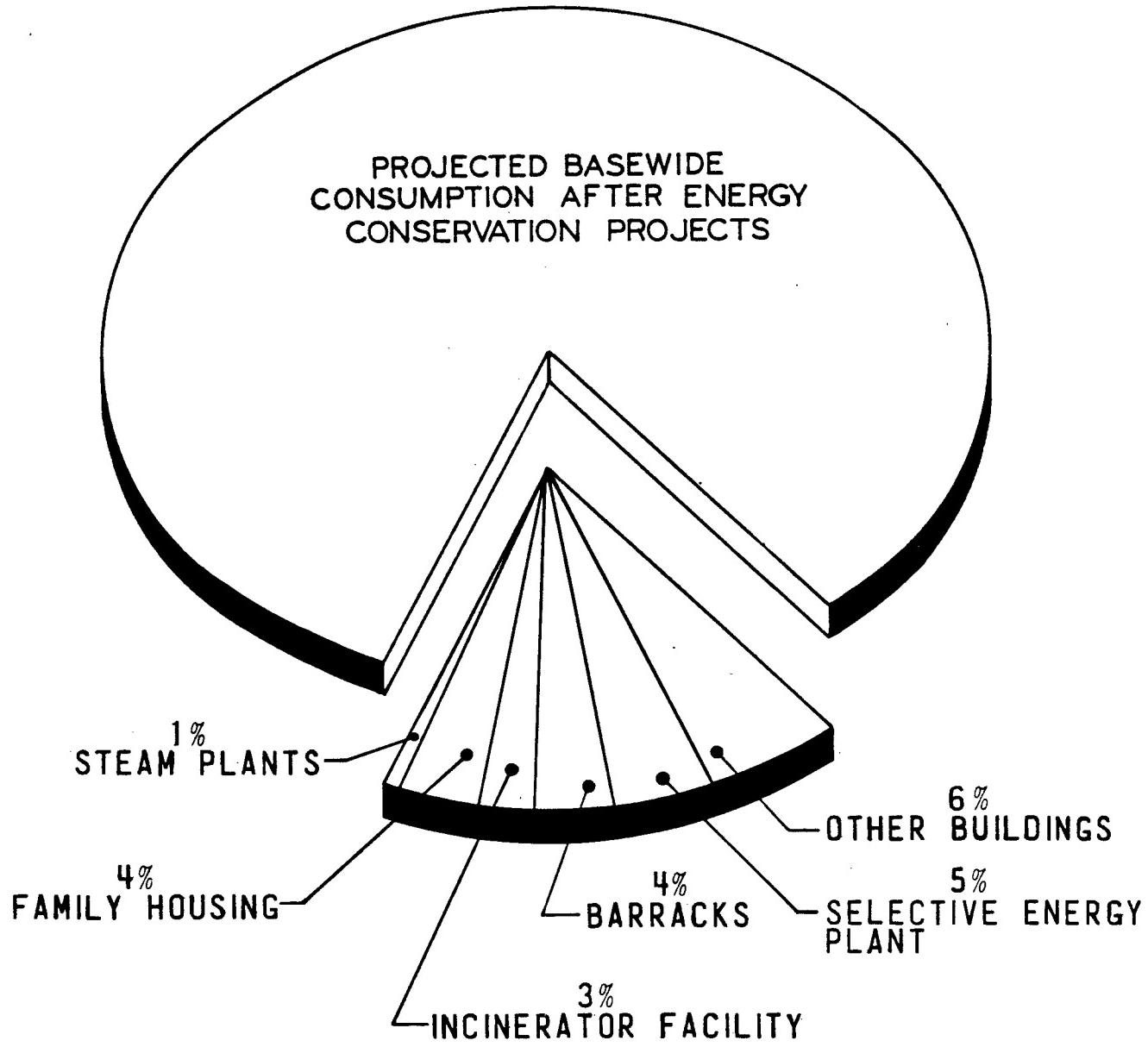


FIGURE 3

to be located near existing Central Energy Plant No. 4333, would provide reduction in both fuel oil and electric consumption totalling 81,113 mega-Btu/year. The details and descriptions of the systems analyzed can be found in the report entitled Total Energy, Selective Energy, and Central Boiler Plants.

The incorporation of a total energy system at this installation would not be recommended. However, a selective energy plant utilizing coal-fired boilers is being recommended. The basewide consumption of fuel oil and natural gas would be reduced by 50 percent, while generating 19 percent of the electrical power required at Fort Jackson. The total annual source energy savings would amount to 5 percent. Detailed descriptions of the TE/SE systems analyzed are included in the Total Energy, Selective Energy, and Central Boiler Plants report.

Table 6 was developed to give a prioritized schedule, in order of fiscal year, for implementing the recommended energy conservation projects.

## EXECUTIVE SUMMARY-INCREMENTS F AND G

Increment F - Facilities Engineer Conservation Measures.

Increment G - Maintenance, Repair, and Minor Construction Projects.

This is a summary of the two phases of work that were started after the completion of Increments A, B, C, D, and E in May of 1980. Increments F and G were completed in November, 1982.

The purpose of Increment F of the Basewide Energy Systems Plan is to identify and develop recommendations that can be used by Fort Jackson in preparing its energy management plan. Included are a number of comparatively low cost projects, recommendations for training, and prioritized lists of possible energy conservation measures. Increment G identified maintenance, repair, and minor construction projects for the purpose of conserving energy. These are energy conservation projects that did not meet ECIP criteria or did not fit the ECIP program at the time that the remainder of the study was completed.

The average costs of energy for FY 1981 are given in Table 7. These costs have been used as the basis for determining the dollar savings per year.

Recommended projects developed within the scope of Increments F and G of the study are summarized in Tables 8 and 9 respectively. Projects are prioritized by their E/C ratio. The E/C ratio is defined as the ratio of yearly energy savings in million Btu to the cost estimate in thousands of dollars. Any project showing a payback of 15 years or less is recommended. Cost estimates are representative of April, 1981 prices.

At the request of Fort Jackson, 1391's were prepared for two of the projects developed under Increment G. The first, Hospital Modification, involves converting the existing Dual Duct HVAC system to a Variable Air Volume system. The second project, EMCS Extension, involves installing reset controls at Moncrief Hospital.

Figure 4 is a pie chart showing projected future energy savings due to ECIP projects developed under Increments A, B, C, D, and E and projects developed under Increments F and G.

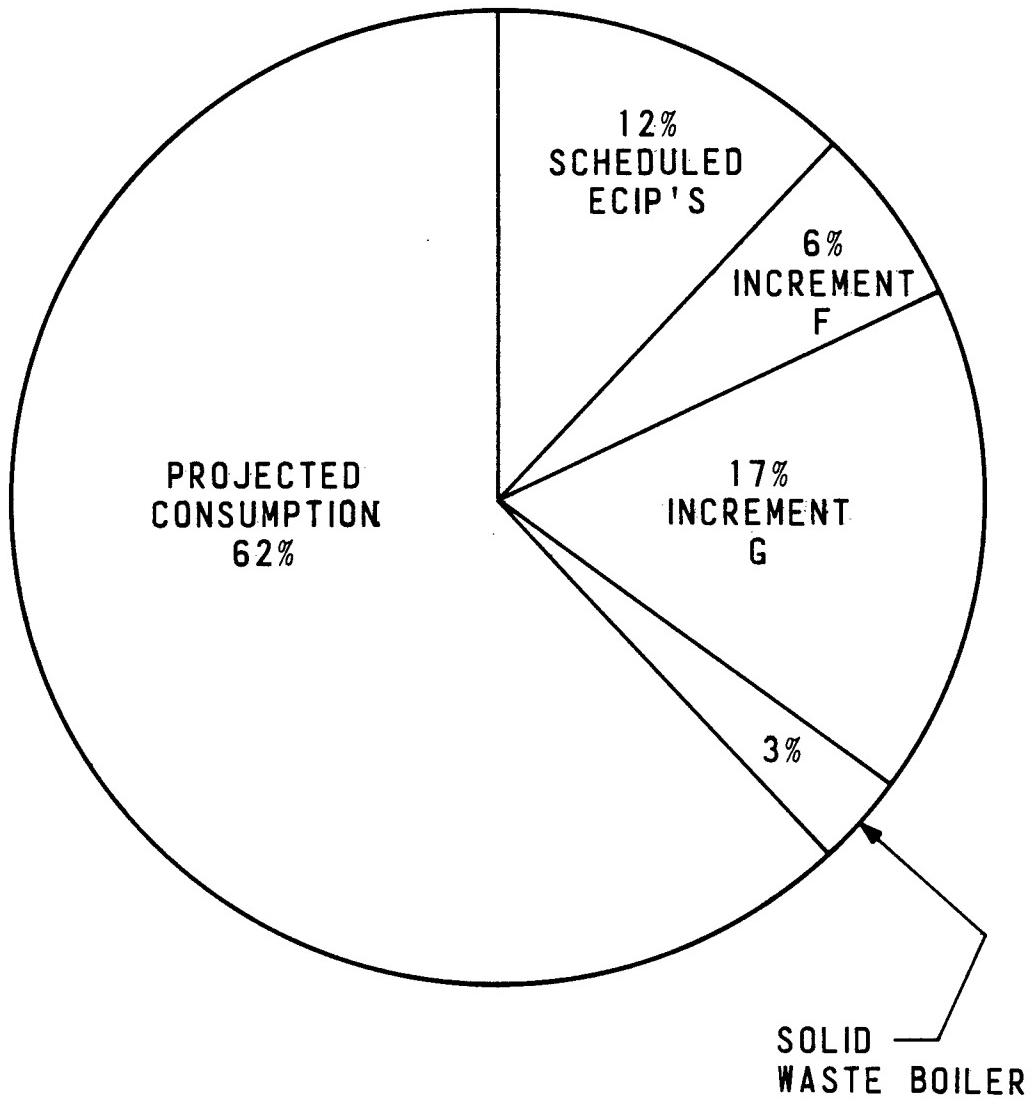
Figure 5 represents a forecast of Fort Jackson's future energy costs. The figure shows how costs could escalate if no energy conservation projects are implemented and what also could happen if all cost effective projects are implemented. The energy conservation projects would more than likely be implemented in three phases:

Phase I - ECIP.

Phase II - Increments F and G and Solid Waste Plant.

Phase III - Selective Energy Plant that would burn coal to produce all the steam requirements and part of the electrical requirements at Fort Jackson.

The curve shows a modest increase in FY86 due to new buildings. The large decrease shown in FY89 is primarily due to using coal, a cheaper fuel, in the Selective Energy Plant.



FORT JACKSON  
BASEWIDE CONSUMPTION FY'81  
( $2,625,074 \times 10^6$  BTU'S)

FIGURE 4

EFFECT OF ESCALATION AND ENERGY  
CONSERVATION ON FUEL COST

WITH CONSERVATION  
NO CONSERVATION  
OVERALL ECONOMY INFLATION

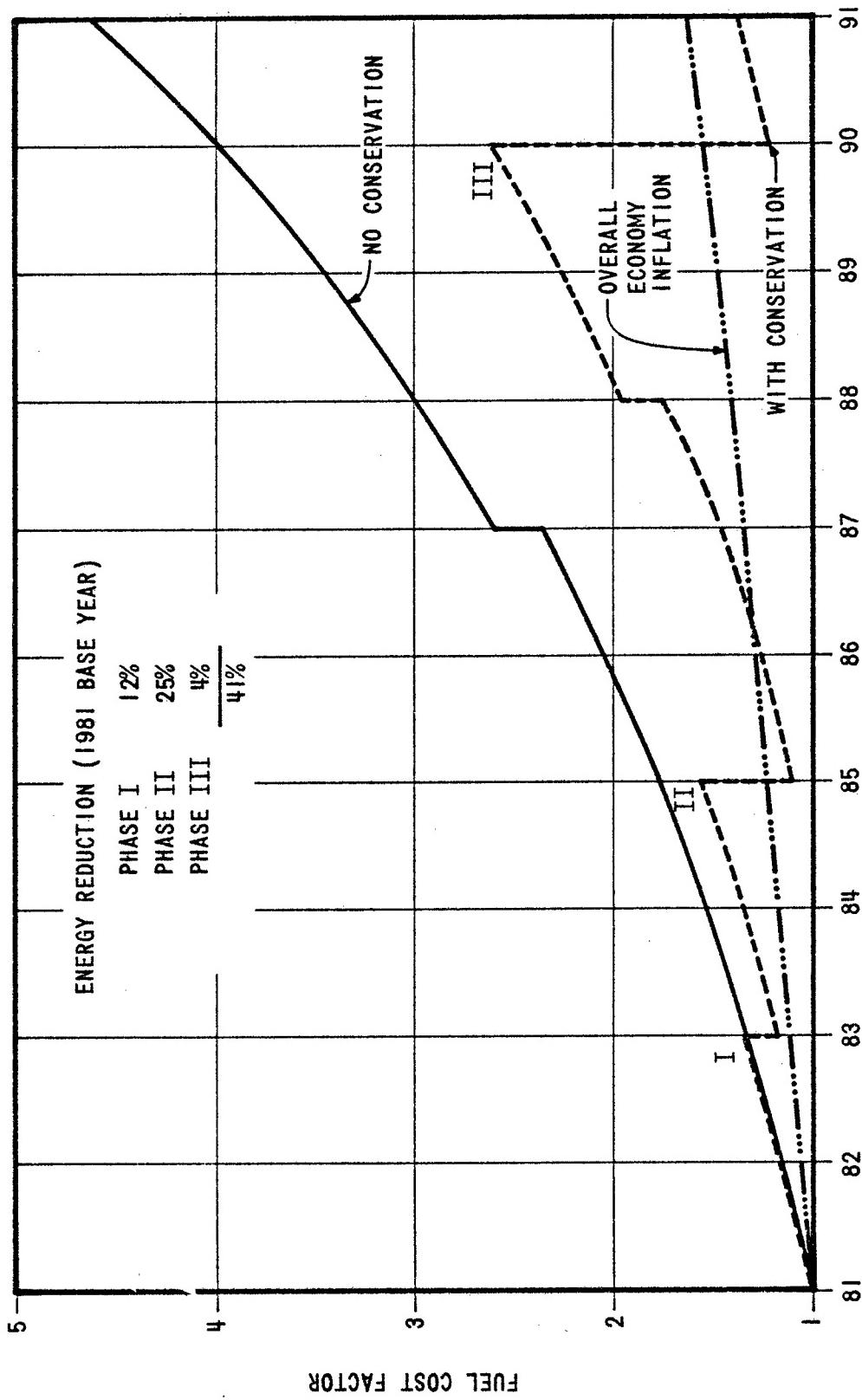


FIGURE 5

**APPENDIX A**

**TABLES**

TABLE I  
TYPICAL BUILDING CONSTRUCTION DATA  
FORT JACKSON

GROUP NO.	BUILDING BLDG. DESCRIPTION	NO. FLS	CONSTRUCTION				'U' VALUES				WINDOW SQ. FT.	AREA (FT. <sup>2</sup> )	COOLING		HEATING		DOMESTIC HOT WATER					
			ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR			SYSTEM	CAP. (TONS)	FUEL	GAIN	LOSS	CAP. (G)				
A-1	2200 SUPPLY/STORAGE	1	BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.10	.30	-	1.13	.85	2861	12876	CENTRAL PLANT	21	C.E. 2288	HTRW	49.4	197.7	75 ELEC	
A-2	4340 BRIGADE HEADQUARTERS	3	BUILT-UP	BRICK & CMU	BASEMENT	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05	.34	-	1.13	.85	672	9955	CENTRAL PLANT	1.	C.E. 4333	HTRW	1.	130.8	75 GAS	
A-3	5448 ADMINISTRATION	1	COMPOSITE	T & G ON WOOD FRAME	TILE, OPEN CRANL. SPACE	SINGLE CLEAR GLASS	SOLID CORE	.26	.23	.53	1.13	.49	815	8020	CHILLER	21	B.P. 5445	STEAM	87.0	201.6	40 ELEC	
A-4	9702 HEADQUARTERS	1	COMPOSITE	T & G ON WOOD FRAME	TILE, OPEN CRANL. SPACE	SINGLE CLEAR GLASS	SOLID CORE	.26	.23	.53	1.13	.49	240	2284	NONE	-	FURNACE	GAS	-	112.0	40 ELEC	
B-1	9524 B.O.Q.	1	COMPOSITE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRANL. SPACE	SINGLE CLEAR GLASS	SOLID CORE	.05	.36	.58	1.13	.49	110	1512	WINDOW UNITS	6	BOILER	OIL	17.1	35.7	66 ELEC	
B-2	9545 BARRACKS	2	ASPHALT SHINGLES	WOOD SIDING	WOOD	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.07	.25	.16	1.13	.55	734	5310	NONE	-	FURNACE	GAS	-	88.8	85 GAS	
B-3	2205 BARRACKS	3	BUILT-UP	BRICK ON CONC. FRAME	TILE, VENTED CRANL. SPACE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.04	.29	.52	1.13	.55	4928	41496	CENTRAL PLANT	60	C.E. 2288	HTRW	659.7	229.0	300 HTRW	
B-4	5422 BARRACKS/MESS	3	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.07	.27	-	1.13	.55	26207	329165	CENTRAL PLANT	171	C.E. 4333	HTRW	31888	1162	1000 HTRW	
C3-1	9510 THEATRE	1	ASPHALT SHINGLES	WOOD SIDING & FRAME	WOOD, CLOSED CRANL. SPACE	SINGLE CLEAR GLASS	SOLID CORE	.27	.19	.37	1.13	.49	82	12339	CHILLER	78	BOILER	GAS	77.6	221.0	NONE -	
CG-2	9631 BARBER SHOP	1	COMPOSITE	CLAPBOARD ON WOOD FRAME	TILE, VENTED CRANL. SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05	.36	.38	1.13	.46	231	1150	NONE	-	FURNACE	OIL	-	19.2	75 ELEC	
CS-4	5346 EDUCATION CENTER	1	SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRANL. SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.00	.26	.54	1.13	.49	110	4074	WINDOW UNITS	12	B.P. 5445	STEAM	84.5	195.2	NONE -	
CS-5	2009 GYMNASIUM	1	BUILT-UP	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.07	.51	-	1.13	.55	1676	20286	NONE	-	C.E. 2288	HTRW	-	481.5	85 HTRW	
CS-6	4532 SERVICE STATION	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.56	.53	-	1.13	.55	258	3087	WINDOW UNIT	3	FURNACE	OIL	16.2	127.3	NONE -	
CS-7	2395 BOWLING CENTER	1	BUILT-UP	BRICK CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.2	.3	-	1.13	.55	49	20380	CENTRAL PLANT	39	C.E. 2288	HTRW	36.2	292.7	30 ELEC	
CS-8	10762 DAY ROOM	1	COMPOSITE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRANL. SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.36	.34	1.13	.49	940	1230	NONE	-	FURNACE	GAS	-	75.0	40 GAS	
CS-9	8568 OFFICE	2	TRANSPORTATION	ASPHALT SHINGLES	WOOD SIDING & FRAME	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.07	.25	.16	1.13	.55	632	4720	WINDOW UNITS	12	BOILER	OIL	18.9	97.6	NONE -	
CS-10	2558 LATRINE	1	WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	SOLID CORE	WOOD SOLID CORE	.17	.36	-	1.13	.49	27	358	NONE	-	FURNACE	GAS	-	11.9	90 GAS	
CS-11	4202 TELEPHONE EXCHANGE BLDG.	1	BUILT-UP	STUCCO ON CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.1	.46	-	1.13	.49	33	3640	PACKAGE UNITS	12	BOILER	HOT WATER	38.0	97.6	NONE -	
D-1	12111 MESS	1	COMPOSITE	SHINGLES	TILE, CLOSED CRANL. SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05	.32	.23	1.13	.55	97	2360	NONE	-	UNIT HEATERS	GAS	-	65.1	100 GAS	
D-2	3210 MESS	1	BUILT-UP	BRICK & CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD HOLLOW CORE	.04	.25	-	1.13	.55	1521	13280	CENTRAL PLANT	51	C.E. 2288	HTRW	56.0	145.3	300 HTRW	
D-3	3630 OFFICER'S MESS	1	BUILT-UP	WOOD SIDING A FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	SOLID CORE	.04	.07	-	1.13	.49	1192	20788	CHILLERS	150	BOILER	OIL	59.3	217.6	100 OIL	
E-2	5615 EDUCATION	1	BUILT-UP	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.42	.33	-	1.13	.55	3702	22667	CENTRAL PLANT	99	BOILER	OIL	356.2	937.9	90 OIL	
FH-1	3713 FAMILY HOUSING	2	ASPHALT SHINGLES	BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.08	.09	.11	1.13	.49	722	9408	COND. UNITS	9	FURNACE	GAS	35.6	911.4	40 GAS	
FH-2	5724 FAMILY HOUSING	2	ASPHALT SHINGLES	WOOD	WOOD SIDING	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.07	-	1.13	.49	1182	5488	COND. UNITS	24	FURNACE	GAS	33.7	911.6	40 GAS	
FH-3	6832 FAMILY HOUSING	2	BUILT-UP	BRICK	ASPH. SHINGLES	BASEMENT	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.07	-	1.13	.49	274	2910	COND. UNITS	9	FURNACE	GAS	12.7	35.4	40 GAS
FH-4	6841 FAMILY HOUSING	1	BUILT-UP	ASPH. SHINGLES	HARDWOOD	SINGLE CLEAR GLASS	WOOD SOLID CORE	.64	.07	.35	1.13	.49	209	21M2	COND. UNITS	9	FURNACE	GAS	18.6	44.9	30 GAS	

1. TYPICAL BUILDING LISTED HAS COOLING, HOWEVER BASEMENT ENERGY MODEL DOES NOT INCLUDE ANY SOURCE ENERGY CONSUMPTION FOR COOLING.

TABLE I (CONT'D)  
TYPICAL BUILDING CONSTRUCTION DATA  
FORT JACKSON

GROUP NO.	BUILDING BLDG.	DESCRIPTION	CONSTRUCTION						'U' VALUES						WINDOW SQ. FT.	AREA (FT. <sup>2</sup> )	COOLING		HEATING		DOMESTIC HOT WATER CAP. (GPM)			
			NO. FLS	WALL	ROOF	FLOOR	WINDOW	SOLID GLASS	WOOD SOLID CORE			COND. SYSTEM (TONS)	FUEL GAIN	LOSS	CAP. (GPM)									
FH-5	5716 FAMILY HOUSING	1 ASPHALT SHINGLES	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.10	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	2250	2033	6 COND. UNITS	6 FURNACE	GAS	11.5	40.2	30 GAS	
FH-6	9600 FAMILY HOUSING	1 ASPHALT SHINGLES	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.12	—	1.06 .47	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	297	3889	6 COND. UNITS	6 FURNACE	GAS	7.0	29.0	30 GAS	
FH-7	3803 FAMILY HOUSING	2 ASPHALT SHINGLES	WOOD SIDING PANELING	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.07	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	23	426	3 COND. UNITS	3 FURNACE	GAS	16.0	55.2	80 GAS	
H-1	6519 PLATOON	1 COMPOSITE SHINGLES	CLAPBOARD ON WOOD	TILE, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.26	.23	.23	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	2284	2284	—	—	FURNACE	—	115.6	40 GAS	
H-4	4323 DENTAL CLINIC	1 BUILT-UP	CONCRETE BLOCK, BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.04	.29	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	487	11897	51 COND. UNIT	51 CENTRAL PLANT	51 C.E. #333 HTW	41.4	171.6	200 HTW	
I-1	10404 TRAINING	1 BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.39	.53	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	3747	3747	15 COND. UNIT	15 FURNACE	GAS	57.5	136.8	40 GAS	
I-3	5462 FIRST-AID CLASSROOM	1 COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.26	.54	1.06 .47	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	5227	5227	—	—	B.P. 5465 STEAM	—	239.2	HOME —		
I-4	2300 INSTRUCTION FACILITY	3 ASPHALT SHINGLES	CLAY TILE	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.06	.32	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1567	67661	1 CENTRAL PLANT	1 C.E. 2286 HTW	1 C.E. 4333 HTW	862.9	90	HHTW	
L-1	1564 LAUNDRY	1 BUILT-UP	CLAPBOARD ON WOOD FRAME	CONGC., CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.45	.21	.59	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	53665	53665	—	—	B.P. 1553 STEAM	—	937.6	N/A STEAM	
LA-1	9504 LABORATORY	1 BUILT-UP	CONCRETE BLOCK	CLAPBOARD ON WOOD FRAME	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.05	.32	—	1.06 .47	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	4782	4782	—	—	BOILER	GAS	—	542.3	30 GAS
LA-2	1896 RECEPTION PROCESSING	2 BUILT-UP	CONCRETE BLOCK, BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.21	.20	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	5735	13187	1 CHILLER	280 BOILER	HTHW #35.9 #69.2	325.9	609.2	200 STEAM	
H-1	6500 MAINTENANCE	1 COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.44	.27	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	3108	3108	—	—	FURNACE	DIL	—	73.62	HOME —
H-2	3039 MOTOR REPAIR SHOP	1 CONCRETE SLAB	BRICK & CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.26	.36	—	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	4787	995	—	—	BOILER	HTHW	—	130.8	76 GAS
H-3	1611 TANK REPAIR	1 BUILT-UP	CORRUGATED METAL SIDING	T & G FLOORING	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.27	1.11	.43	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	5110	24838	3 WINDOW UNIT	3 BOILER	DIL	13.1	806.2	76 DIL	
R-1	1210 <sup>a</sup> CHAPEL	1 COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	T & G, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.34	.26	.19	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	3846	3846	—	—	BOILER	GAS	53.0	139.2	30 GAS
R-2	11550 CHAPEL	1 COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	T & G, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.34	.26	.19	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	500	5300	—	—	FURNACE	DIL	—	111.0	30 DIL
U-2	ALL BLDGS. IN THE GROUP	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	9427	—	—	—	NOT APPLICABLE	—	—	—	
U-3	ALL BLDGS. IN THE GROUP	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	3631	—	—	—	NOT APPLICABLE	—	—	—	
U-4	5485 HEATING & COOLING PLANT	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	6303	—	—	—	NOT APPLICABLE	—	—	—	
W-1	2530 WAREHOUSE	1 ASPHALT SHINGLES	CLAPBOARD ON WOOD FRAME	CONCRETE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.44	.36	.84	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	1.13 .49	45	9373	3 WINDOW UNIT	3 SPACE HEATERS	GAS	26.5	93.4	40 GAS	
X	NO UTILITIES	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	
Z	ALL BLDG. IN THE GROUP	ELECTRIC ONLY	(INCLUDES OUTDOOR LIGHTING AND AUXILIARIES)	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—	

1. TYPICAL BUILDING LISTED HAS COOLING, HOWEVER BASESIDE ENERGY MODEL DOES NOT INCLUDE ANY SOURCE ENERGY CONSUMPTION FOR COOLING.

**TABLE 2**  
**TYPICAL BUILDING ENERGY CONSUMPTION DATA**  
**FORT JACKSON**

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTUx10 <sup>6</sup>			ELEC'L ENER. CONSUMPTION		BTU x 10 <sup>3</sup> FT <sup>2</sup>
			FUEL	ELEC.	TOTAL	KW PEAK	KWH/YR	
A-1	2200	SUPPLY/STORAGE	1369	537	1906	15	46237	146.9
A-2	4340	BRIGADE HEADQUARTERS	564	1507	2071	27	129884	208.0
A-3	5448	ADMINISTRATION	898	691	1589	40	59530	198.1
A-4	9702	HEADQUARTERS	602	185	787	6	16007	344.6
B-1	9524	B.O.Q.	167	201	368	11	17310	243.4
B-2	9545	BARRACKS	1081	103	1184	3	8906	223.0
B-3	2205	BARRACKS	6549	1998	8547	31	172224	206.0
B-4	5422	BARRACKS/MESS	22016	47732	69748	1045	4114870	211.9
C3-1	9510	THEATRE	1257	1471	2728	106	126752	224.7
C3-2	9631	BARBER SHOP	266	42	308	1	3552	267.8
CS-4	5346	EDUCATION CENTER	812	889	1701	36	76607	417.5
CS-5	2009	GYMNASIUM	2034	2491	4525	80	214739	223.1
CS-6	4522	SERVICE STATION	333	461	794	12	39730	257.2
CS-7	2395	BOWLING CENTER	4971	5749	10720	140	495586	526.0
CS-8	10762	DAY ROOM	396	149	545	4	12886	436.0
CS-9	8568	TRANSPORTATION OFFICE	540	486	1026	22	41906	217.4
CS-10	2558	LATRINE	277	25	302	1	2165	843.6
CS-11	4292	TELEPHONE EXCHANGE BLDG.	247	1346	1593	28	116077	437.6
D-1	12111	MESS	250	630	880	35	54347	372.9
D-2	3210	MESS	6363	6426	12791	105	553949	963.2
D-3	3630	OFFICER'S MESS	2047	3638	5685	149	313670	273.5
E-2	5615	PRIMARY EDUCATION	10089	1381	11470	36	119017	506.0
FH-1	3773	FAMILY HOUSING	647	765	1412	19	65984	150.1
FH-2	5724	FAMILY HOUSING	531	754	1285	36	65009	234.1
FH-3	6832	FAMILY HOUSING	342	244	586	10	21057	201.4
FH-4	6841	FAMILY HOUSING	434	229	733	12	25761	342.2

TABLE 2 (CONT'D)  
TYPICAL BUILDING ENERGY CONSUMPTION DATA  
FORT JACKSON

**TABLE 3**  
**BUILDING OCCUPANCY**  
**FORT JACKSON**

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NORMAL PEAK POPULATION	OCCUPANCY
A-1	2200	SUPPLY/STORAGE	9	WEEKDAYS - 7:00 A.M. TO 6:00 P.M.
A-2	4340	BRIGADE HEADQUARTERS	40	WEEKDAYS - 7:30 A.M. TO 5:00 P.M.
A-3	5448	ADMINISTRATION	24	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
A-4	9702	HEADQUARTERS	10	OPEN 24 HOURS
B-1	9524	B.O.Q.	19	OPEN 24 HOURS
B-2	9585	BARRACKS	28	OPEN 24 HOURS
B-3	2205	BARRACKS	290	OPEN 24 HOURS
B-4	5422	BARRACKS/MESS	1200	OPEN 24 HOURS
CS-1	9510	THEATRE	1000	7 DAYS A WEEK - NOON TO 11:00 P.M.
CS-2	9631	BARBER SHOP	6	MONDAY THRU SATURDAY - 8:00 A.M. TO 5:00 P.M.
CS-4	5346	EDUCATION CENTER	33	MONDAY THRU THURSDAY - 7:30 A.M. TO 9:15 P.M. FRIDAY - 7:30 A.M. TO 4:15 P.M., SATURDAY - 7:30 A.M. TO 11:30 A.M.
CS-5	2009	GYMNASIUM	700	7 DAYS A WEEK - 8:00 A.M. TO 8:00 P.M.
CS-6	4522	SERVICE STATION	8	WEEKDAYS - 7:30 A.M. TO 7:00 P.M., SATURDAY - 9:00 A.M. TO 6:00 P.M. SUNDAY - 11:00 A.M. TO 5:00 P.M.
CS-7	2395	BOWLING CENTER	360	MONDAY THRU FRIDAY - 8:00 P.M. TO 11:00 P.M. SATURDAY, SUNDAY & HOLIDAYS - 10:00 A.M. TO 11:00 P.M.
CS-8	10762	DAY ROOM	25	WEEKDAYS - 8:30 P.M. TO 10:00 P.M.
CS-9	8568	TRANSPORTATION OFFICE	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
CS-10	2558	LATRINE	15	WEEKDAYS - 6:00 A.M. TO 6:00 P.M.
CS-11	4282	TELEPHONE EXCHANGE BLDG.	10	7 DAYS A WEEK - 7:30 A.M. TO 11:00 P.M.
D-1	12111	MESS	86	WEEKDAYS - 5:00 A.M. TO 7:00 P.M.
D-2	3210	MESS	250	WEEKDAYS - 6:00 A.M. TO 7:00 P.M.
D-3	3630	OFFICER'S MESS	80	7 DAYS A WEEK - 8:00 A.M. TO 1:00 P.M.
E-2	5615	PRIMARY EDUCATION	320	WEEKDAYS - 8:00 A.M. TO 4:00 P.M.
FH-1	3773	FAMILY HOUSING	32	OPEN 24 HOURS
FH-2	5724	FAMILY HOUSING	16	OPEN 24 HOURS
FH-3	6832	FAMILY HOUSING	8	OPEN 24 HOURS
FH-4	6841	FAMILY HOUSING	8	OPEN 24 HOURS
FH-5	5716	FAMILY HOUSING	8	OPEN 24 HOURS
FH-6	3600	FAMILY HOUSING	4	OPEN 24 HOURS
FH-7	3805	FAMILY HOUSING	8	OPEN 24 HOURS
H-1	6549	OFFICE MOTIVATION PLATOON	10	OPEN 24 HOURS
H-4	4323	DENTAL CLINIC	50	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
I-1	10404	TRAINING	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
I-3	5462	FIRST AID CLASSROOM	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
I-4	2300	INSTRUCTION FACILITY	376	WEEKDAYS - 6:30 A.M. TO 3:30 P.M.
L-1	1561	LAUNDRY	81	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
LA-1	9504	LABORATORY	15	WEEKDAYS - 7:00 A.M. TO 4:00 P.M.
LA-2	1895	RECEPTION PROCESSING	90	WEEKDAYS - 6:00 A.M. TO 5:00 P.M.

**TABLE 3 (CONT'D)  
BUILDING OCCUPANCY  
FORT JACKSON**

TABLE 4  
Building Group Source Energy Consumption

Group	Description	Group Sq. Ft.	Total Source Consumption <sup>6</sup> Btu's x 10 <sup>6</sup>
A	Administrative	708,941	178,148
B	Barracks	4,113,791	875,800
CS	Community Service	618,388	202,655
D	Dining	371,309	243,599
E	Education Facilities	64,069	32,460
F	Family Housing	1,716,078	366,282
H	Hospital	530,170	148,062
I	Instruction Facilities	535,602	139,761
L	Laundry	53,565	33,037
LA	Laboratory Facilities	233,217	49,376
M	Maintenance	346,535	45,550
R	Religious Facilities	64,067	14,127
W	Warehouse	535,781	38,355
U-2	Water Treatment	9,427	5,708
U-3	Pump Houses	3,631	18,320
U-4	Boiler Plants	43,880	26,313
X	Buildings with no Utilities	115,555	
Z	Electric Only (includes outdoor lights)	145,766	108,443

**ENERGY CONSERVATION PROJECTS  
SOURCE ENERGY SAVINGS**

BUILDING TYPE	ENERGY SAVINGS (BTUx1,000,000)	% BASEWIDE REDUCTION FY'75	PROJECT NUMBER
FAMILY HOUSING	47,466 37,927 19,353 <hr/> 104,746	1.82 1.45 0.74 <hr/> 4.01	T-507 T-521 T-520
BARRACKS	1,420 45,374 40,872 10,130 <hr/> 97,796	.05 1.74 1.57 .39 <hr/> 3.75	T-510 T-509 T-518 T-539
INCINERATOR FACILITY	81,113	3.11	T-529
STEAM PLANTS	26,451	1.01	T-517
SELECTIVE ENERGY PLANT	140,000	5.36	
OTHER BUILDINGS AFFECTED BY ECIP'S	15,883  14,318 25,239 91,438 <hr/> 146,878	.61  0.55 0.97 3.50 <hr/> 5.63	T-510  T-518 T-520 T-539
TOTAL	596,984	22.87	

TABLE 5

ENERGY CONSERVATION PROJECTS DEVELOPED SCHEDULE - FT. JACKSON, SOUTH CAROLINA

PROJECT TITLE	PROJECT NUMBER	RECOMMENDED FISCAL YEAR	COST \$ x 1000	E/C RATIO	ENERGY SAVINGS BTUx1,000,000	YEARS PAYBACK	B/C RATIO
RELAMPING FLUORESCENT FIXTURES	T-510	1980	227	76.4	17,303	1.8	4.5
STORM WINDOWS, WEATHERSTRIP DOORS, AND KITCHEN LIGHTING FIXTURE IN FAMILY HOUSING	T-507	1980	1044	47.9	47,466	6.4	2.8
INSULATED PANELS, STORM WINDOWS, HALL LIGHTING FIXTURES, AND WEATHERSTRIP DOORS IN PERMANENT BARRACKS	T-509	1980	1495	30.4	45,374	8.1	2.3
<b>TOTAL</b>			2766		110,143		
FAMILY HOUSING EQUIPMENT MODIFICATIONS (ECIP)	T-521	1981	1084	36.9	37,927	11.5	1.7
ADJUST FRESH AIR QUANTITIES	T-518	1981	268	205.8	55,190	1.5	12.3
STEAM PLANT MODIFICATIONS	T-517	1981	301	87.9	26,451	3.6	5.5
FM RADIO CONTROL SYSTEM	T-520	1981	600	74.3	44,592	2.4	5.1
<b>TOTAL</b>			2253		164,160		
SOLID WASTE BURNING INCINERATOR FACILITY	T-529	1982	3182	25.5	81,113	22.5	1.1
EMCS EXTENSION	T-539	1982	862	117.8	101,568	2.6	4.9
<b>TOTAL</b>			4044		182,681		
SELECTIVE ENERGY PLANT	1983	27400	N/A	140,000	14.0	1.7	
<b>TOTAL</b>		27400		140,000			

TABLE 6

TABLE 7

## FY81 Average Energy Costs

<b>Electricity</b>	
Demand	\$6.85/kW
kWh (without demand)	\$ .02337/kWh
kWh (including demand)	\$ .03702/kWh
<b>Natural Gas</b>	
Firm	\$2.645/mcf
Interruptible	\$3.525/mcf
Combination	\$3.308/mcf
<b>Propane</b>	
Commodity	\$0.6239/gal.
<b>Fuel Oil</b>	
No. 2	\$1.22/gal.
No. 6	\$ .87/gal.

$$\frac{10,000 \text{ Btu}}{1000 \text{ Btu/lb}} \times \frac{1 \text{ gal}}{95,500 \text{ Btu/lb}} \times \frac{\$}{\text{gal}}$$

$$\frac{1,000,000}{95,500} \times \$1/\text{gal.} =$$

TABLE 8  
Summary of Increment F Projects

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost</u>	<u>Manhours</u>	<u>Reference Pages</u>	<u>Narr. Calcs.</u>
<u>Reduction-of-Ventilation Air Quantities</u>	14 Bldgs.	52,674	\$ 243,354	.02	1274.	9,177 \$	5,740 \$	0	A/C Mechanic	265	8	A1
Cycle Pool Pumps	5 pumps	1,135	3,019	.17	122.	2,154	527	270	Electrician	4	35	A163
Chilled Water Supply Modification in Laundry Rooms	5422 and 5482	2,820	13,028	0.2	265.	1,912	1,475	417	A/C Mechanic	40	19	A77
Water Restrictors (Hot)	Per Unit Basis	10.9	62.7	.13	201.0	1,351	8.07	3.70	Laborer .1		32	A137
Receptacle Insulation	Family Housing	20,053	87,967	0.3	74.0	669	29,954	3,943	Laborer 1,149		16	A48
Swimming Pool Cover	Bldg. 3296	2,245	10,372	.4	79.0	568	4,000	-	-		39	A197
Furnace Derating	Family Housing	5,676	26,223	0.4	77.0	555	10,221	0	Heat Shop	383	30	A129
Filter Maintenance	Basevde	11,411	9,535	0.8	18.3	295	38,619	7,707	Laborer 2,080		14	A37
Insulate Water Heaters	Family Housing	3,024	13,971	1.2	25.0	181	16,747	3,964	Laborer 575		38	A189
Reduce Infiltration in Family Housing	Family Housing	41,776	182,982	1.8	14.0	126	332,419	80,425	Laborer 12,064		12	A26
Photocells for Warehouse Exterior Lighting	Warehouses	133	561	2.0	10.7	120	1,109	398	Electrician 21		18	A65
Solar Film (West)	Sq. Ft. Basis	.1302	.60	5.6	5.4	39	2.54	--	--		23	A93
Solar Film (Southwest)	Sq. Ft. Basis	.1231	.57	5.9	5.1	37	2.54	--	--		23	A93

**TABLE 8**  
Summary of Increment F Projects  
Continued

Project	Location(s)	Energy Savings/Year MMBtu	Payback Years	Contract			In-House Cost Manhours	Reference Pages Narr. Calcs.
				B/C	E/C	Cost Material		
Window Insulation,	26 Bldgs.	2,555	11,804	6.2	4.9	35	72,926	32,364 Laborer 2,342
Electronic Ignition in Furnaces	Family Housing	8,321	37,875	6.4	4.5	34	242,139	133,214 Heat Shop 2,300
Solar Film (East)	Sq. Ft. Basis	.1095	.51	6.6	4.6	33	2.54	-- --
Solar Film (Southeast)	Sq. Ft. Basis	.1023	.47	7.1	4.2	31	2.54	-- --
Solar Film (Northwest)	Sq. Ft. Basis	.0961	.44	7.6	3.9	29	2.54	-- --
Vent Restrictors	Family Housing	3,677	16,988	7.8	3.8	28	133,177	7,866 Heat Shop 5,900
Vent Dampers	Family Housing	4,900	22,638	8.0	3.7	27	181,605	72,435 Heat Shop 2,873
Solar Film (Northeast)	Sq. Ft. Basis	.0891	.41	8.2	3.7	27	2.54	-- --
Solar Film (South)	Sq. Ft. Basis	.0829	.38	8.8	3.4	25	2.54	-- --
Variable Air Volume	Bldg. 3319	563	2,376	11.0	2.0	21	26,300	11,421 A/C Mechanic 405
Indoor Swimming Pool Lighting Upgrade	Bldg. 3296	856	11,218	3.1	3.9	20	34,830	20,508 Electrician 192
Solar Film (North)	Sq. Ft. Basis	.0588	.27	12.4	2.4	18	2.54	-- --
Fluorescent Lighting Ballast Replacement	Per Unit Basis	.386	1.63	16.0	1.3	15	26.0	26.0 0
Skylights	Bldg. 3296	375	1,013	32.0	0.7	12	32,000	8,413 Laborer 480
Water Restrictors (Cold)	Per Unit Basis	0	12.4	0.7	14.0	0	8.07	3.70 Laborer .1

**TABLE 8**  
**Summary of Increment F Projects**  
**Continued**

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>Contract Cost</u>			<u>In-House Cost</u>		<u>Narr.</u>	<u>Reference Pages</u>	<u>Calcs.</u>
					<u>B/C</u>	<u>E/C</u>	<u>Material</u>	<u>Manhours</u>				
Toilet Tank Dams	Family Housing	0	6,819	1.4	6.6	0	9,355	4,129	Laborer 191	34	A156	
Flush Valve Restrictors	Basewide	0	26,700	0.6	15.0	0	16,604	8,198	Laborer 267	33	A145	
Computer Room Modification	Bldg. 2572	-95	1,180	2.5	2.0	-32	2,938	2,174	A/C Mechanic 32	36	A169	

**TABLE 9**  
**Summary of Project Data - Increment G**

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u> <u>MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost</u>	<u>Manhours</u>	<u>Narr.</u>	<u>Reference Pages</u>	<u>Calcs.</u>
Operating Room Modifications	Moncrief Hospital	4,162	\$19,228	0.13	219.	1,580	\$2,600	-	-	-	35	B-217	
Submersible Pumps for Valve Pits	Building 3300	357	1,724	0.2	164.	1,170	305	\$ 178	Electrician	1.5	23	B-147	
Bulb-Type Thermostats	Basewide	213,334	985,603	0.2	136.	995	214,438	180,720	Electrician	2,050	26	B-164	
Pipe Insulation	111 Buildings	19,816	91,550	0.5	57.	412	48,032	15,465	Insulator	1,124	25	B-155	
Variable Speed Chilled Water Pumping	Bldgs. 1699, 27,169 2288, and 4333	72,270	1.4	15.4	272	99,960	75,500	Electrician	50	13	B-91		
<u>EM Control System Expansion</u>	Postwide	68,516	316,544	2.4	12.3	89	772,000	359,000	Electrician	8,736	37	B-228	
Automatic Chiller Condenser Tube Cleaning	2 - 700 ton centra-vac	4,777	22,070	2.5	12.5	86	55,556	-	-	-	4	B-1	
Automatic Chiller Condenser Tube Cleaning	2 - 1,165 ton absorption	7,719	35,662	3.5	8.5	61	126,180	-	-	-	4	B-1	
Fluorescent Lighting Load Reduction	Basewide	17,066	141,397	2.1	9.7	57	296,672	157,813	Laborer	2,612	6	B-50	
Automatic Chiller Condenser Tube Cleaning	5 - 700 ton absorption	11,944	55,181	4.0	7.5	54	220,881	-	-	-	4	B-1	
Automatic Chiller Condenser Tube Cleaning	1 - 600 ton absorption	1,988	9,185	4.6	6.5	47	42,675	-	-	-	4	B-1	
Boiler Upgrade	1 Barracks	196	906	4.8	6.2	45	4,390	2,763	Heat Shop	16	11	B-83	

TABLE 9  
Summary of Project Data - Increment G  
(Continued)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u> <u>MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost</u> <u>Nanhours</u>	<u>Narr.</u>	<u>Pages</u>	<u>Reference</u>	
Automatic Chiller Condenser Tube Cleaning	1 - 235 ton centra-vac	802	3,705	5.0	6.1	44	18,374	-	-	4	B-1		
Hospital Modifications	Bldg. 4500	29,460	\$136,105	4.9	6.1	44	\$667,200	-	-	33	B-203		
Variable Speed Hot Water Pumping	Bldgs. 1699, 5,173 2288, and 4333	13,760	8.6	2.5	44	118,494	\$103,488	Electrician	96	15	B-99		
<del>ENCS Extension</del>	Moncrief Hospital	8,403	38,822	5.7	5.3	38	221,000	-	-	31	B-191		
Ceiling Fans	26 Buildings	1,737	9,201	6.4	4.9	30	58,700	21,438	Electrician General	900	8	B-68	
Window Reduction	Permanent Barracks and Mess Halls	15,705	72,834	7.5	4.0	29	546,267	288,285	Carpenter	10,519	19	B-118	
Automatic Chiller Condenser Tube Cleaning	1 - 235 ton absorption	802	3,705	8.0	3.7	27	29,767	-	-	4	B-1		
Insulate Warehouse Offices	2500 and 3500 Areas	1,376	6,357	9.1	3.3	24	58,035	22,254	Laborer	1,472	17	B-108	
Storm Doors	Family Housing	4,534	20,152	10.5	2.5	21	212,440	115,016	Carpenter	1,149	21	B-131	
Infra-Red Heating	5 Buildings	667	3,082	15.0	2.0	14	46,717	18,178	Heat Shop	924	28	B-176	
Replace Incandescent Lighting with HPS	Hospital Area Per Unit Basis	4.95	13.2	19.1	.9	12	423	269	Electrician	2	22	B-142	